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CLAIMS: I claim:

- 1. A process for treating HAPs in air to ultra-low emission limits, said process to include the steps of:
 - a. Passing the air stream through a bed of synthetic adsorbent;
 - b. Removing the adsorbent to a regeneration column;
 - c. Regenerating the adsorbent at elevated temperature and above-atmospheric pressure in a highly turbulent fluidized bed operating as an equilibrium-stage column;
 - d. Cooling of the adsorbent;
 - e. Placement of the adsorbent back into the adsorption bed;
 - f. Destruction of the HAP vapors using a catalytic oxidizer;
 - g. Scrubbing of the vapors with a caustic scrubber or solid basic adsorbent to remove acid gas; and
 - h. Exhausting the regeneration air stream to the atmosphere.
- 2. A process according to Claim 1, wherein the adsorbent is also hydrophobic.
- 3. A process according to Claim 1, wherein the HAP vapors are destroyed in a thermal oxidizer.
- 4. A process according to Claim 1, wherein the HAP vapors are destroyed in a UV/Oxidation system.
- 5. A process according to Claim 1, wherein the scrubbed vapors are exhausted into the adsorption bed to remove combustion by-products.
- 6. A process according to Claim 1, wherein the regeneration column is placed under vacuum to reduce the temperature required for regeneration.
- 7. A process according to Claim 1, wherein heat recovery is used to minimize operating costs.
- 8. A process according to Claim 1, wherein the inlet air stream is cooled to maximize adsorption of HAPs or low-boiling point compounds.
- 9. A process according to Claim 1, wherein the desorbed HAP vapors are adsorbed onto another adsorbent bed.
- A process according to Claim 1, wherein the adsorption bed and regeneration bed are the same device.
- 11. A process according to Claim 1, wherein the HAP vapors are recovered in liquid or gaseous form for recycling, reuse, or off-site disposal.
- 12. A process according to Claim 1, wherein the regeneration column is heated with a microwave generator;
- 13. Any combination of Claims 1 through 12.

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- 14. A process for treating HAPs in air to ultra-low emission limits, said process to include the steps of:
 - a. Passing the air stream through a bed of synthetic adsorbent;
 - b. Removing the adsorbent to a regeneration column;
 - Regenerating the adsorbent at elevated temperature and above-atmospheric pressure in a highly turbulent fluidized bed operating as an equilibrium-stage column;
 - d. Utilizing an inert gas or a gas with decreased oxygen levels to effect the regeneration to allow for higher temperature in the regeneration column and/or to effect regeneration of higher boiling point compounds without oxidizing the adsorbent;
 - e. Cooling of the adsorbent;
 - f. Placement of the adsorbent back into the adsorption bed;
 - g. Cooling of the desorbed HAP vapors;
 - h. Adsorption of the HAP vapors using an adsorbent bed; and
 - i. Exhausting the regeneration air stream to the atmosphere.
- 15. A process according to Claim 14, wherein the adsorbent is also hydrophobic.
- 16. A process according to Claim 14, wherein oxygen content of the regeneration gas is monitored and/or controlled to allow for higher temperature in the regeneration column and/or to effect regeneration of higher boiling point compounds without oxidizing the adsorbent;
- 17. A process according to Claim 14, wherein oxygen is reintroduced in the HAP vapor stream and the vapors are destroyed in a catalytic oxidizer and the vapors are scrubbed using a caustic scrubber or solid basic adsorbent.
- 18. A process according to Claim 14, wherein oxygen is reintroduced in the HAP vapor stream and the vapors are destroyed in a thermal oxidizer and the vapors are scrubbed using a caustic scrubber or solid basic adsorbent.
- 19. A process according to Claim 14, wherein oxygen is reintroduced in the HAP vapor stream and the vapors are destroyed in a UV/Oxidation system and the vapors are scrubbed using a caustic scrubber or solid basic adsorbent.
- 20. A process according to Claim 14, wherein the HAP vapors are destroyed in a UV/Oxidation system.
- 21. A process according to Claim 14, wherein the scrubbed vapors are exhausted into the adsorption bed to remove combustion by-products.
- 22. A process according to Claim 14, wherein the regeneration column is placed under vacuum to reduce the temperature required for regeneration.
- 23. A process according to Claim 14, wherein heat recovery is used to minimize operating costs.
- 24. A process according to Claim 14, wherein the inlet air stream is cooled to maximize adsorption of HAPs or low-boiling point compounds.
- A process according to Claim 14, wherein the adsorption bed and regeneration bed are the same device.
- 26. A process according to Claim 14, wherein the HAP vapors are recovered in liquid or gaseous form for recycling, reuse, or off-site disposal;
- 27. A process according to Claim 14, wherein the regeneration column is heated with a microwave generator.
- 28. Any combination of Claims 14 through 27.

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- 29. A process for treating HAPs in air to ultra-low emission limits, said process to include the steps of:
 - a. Passing the air stream through a bed of synthetic adsorbent;
 - b. Removing the adsorbent to a regeneration bed;
 - c. Regenerating the adsorbent at elevated temperature and above-atmospheric pressure in a highly turbulent recirculating fluidized bed;
 - d. Cooling of the adsorbent;
 - e. Placement of the adsorbent back into the adsorption bed;
 - f. Destruction of the HAP vapors using a catalytic oxidizer;
 - g. Scrubbing of the vapors with a caustic scrubber or solid basic adsorbent to remove acid gas; and
 - h. Exhausting the regeneration air stream to the atmosphere.
- 30. A process according to Claim 29, wherein the adsorbent is also hydrophobic.
- 31. A process according to Claim 29, wherein the HAP vapors are destroyed in a thermal oxidizer.
- 32. A process according to Claim 29, wherein the HAP vapors are destroyed in a UV/Oxidation system.
- 33. A process according to Claim 29, wherein the scrubbed vapors are exhausted into the adsorption bed to remove combustion by-products.
- 34. A process according to Claim 29, wherein the regeneration bed is placed under vacuum to reduce the temperature required for regeneration.
- 35. A process according to Claim 29, wherein heat recovery is used to minimize operating costs.
- 36. A process according to Claim 29, wherein the inlet air stream is cooled to maximize adsorption of HAPs or low-boiling point compounds.
- 37. A process according to Claim 29, wherein the desorbed HAP vapors are adsorbed onto another adsorbent bed.
- 38. A process according to Claim 29, wherein the adsorption bed and regeneration bed are the same device
- 39. A process according to Claim 29, wherein the HAP vapors are recovered in liquid or gaseous form for recycling, reuse, or off-site disposal;
- 40. A process according to Claim 29, wherein the regeneration column is heated with a microwave generator.
- 41. Any combination of Claims 29 through 40.

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- 42. A process for treating HAPs in air to ultra-low emission limits, said process to include the steps of:
 - a. Passing the air stream through a bed of synthetic adsorbent;
 - b. Removing the adsorbent to a regeneration bed;
 - Regenerating the adsorbent at elevated temperature and above-atmospheric pressure in a highly turbulent recirculating fluidized bed;
 - d. Utilizing an inert gas or a gas with decreased oxygen levels to effect the regeneration to allow for higher temperature in the regeneration column and/or to effect regeneration of higher boiling point compounds without oxidizing the adsorbent;
 - e. Cooling of the adsorbent;
 - f. Placement of the adsorbent back into the adsorption bed;
 - g. Cooling of the desorbed HAP vapors;
 - h. Adsorption of the HAP vapors using an adsorbent bed; and
 - i. Exhausting the regeneration air stream to the atmosphere.
- 43. A process according to Claim 42, wherein the adsorbent is also hydrophobic.
- 44. A process according to Claim 42, wherein oxygen content of the regeneration gas is monitored and/or controlled to allow for higher temperature in the regeneration column and/or to effect regeneration of higher boiling point compounds without oxidizing the adsorbent;
- 45. A process according to Claim 42, wherein oxygen is reintroduced in the HAP vapor stream and the vapors are destroyed in a catalytic oxidizer and the vapors are scrubbed using a caustic scrubber or solid basic adsorbent.
- 46. A process according to Claim 42, wherein oxygen is reintroduced in the HAP vapor stream and the vapors are destroyed in a thermal oxidizer and the vapors are scrubbed using a caustic scrubber or solid basic adsorbent.
- 47. A process according to Claim 42, wherein oxygen is reintroduced in the HAP vapor stream and the vapors are destroyed in a UV/Oxidation system and the vapors are scrubbed using a caustic scrubber or solid basic adsorbent.
- 48. A process according to Claim 42, wherein the HAP vapors are destroyed in a UV/Oxidation system.
- 49. A process according to Claim 42, wherein the scrubbed vapors are exhausted into the adsorption bed to remove combustion by-products.
- 50. A process according to Claim 42, wherein the regeneration column is placed under vacuum to reduce the temperature required for regeneration.
- 51. A process according to Claim 42, wherein heat recovery is used to minimize operating costs.
- 52. A process according to Claim 42, wherein the inlet air stream is cooled to maximize adsorption of HAPs or low-boiling point compounds.
- 53. A process according to Claim 42, wherein the adsorption bed and regeneration bed are the same device.
- 54. A process according to Claim 42, wherein the HAP vapors are recovered in liquid or gaseous form for recycling, reuse, or off-site disposal;
- 55. A process according to Claim 42, wherein the regeneration column is heated with a microwave generator.
- 56. Any combination of Claims 42 through 55.